

711-46-512  
5 111  
25976  
P-2

## FINAL TECHNICAL REPORT ON GRANT NAG8-247

9/15/92 - 9/14/93

## JOVE Program Support

Dr. Jeff Sanny of Loyola Marymount University Physics Department requested Professor. R. L. McPherron of UCLA to act as his mentor in the JOVE program. Dr. Sanny was approved as a JOVE scholar, and Dr. McPherron subsequently received the subject grant to support his mentoring activities.

Beginning in September 1992 Prof. McPherron provided office space in the Geology building at UCLA for Dr. Sanny. Dr. Sanny spent one day per week at UCLA during the first year of his grant. These visits allowed Dr. Sanny to participate with Prof. McPherron's research group. Dr. McPherron's secretary, Sandra Topete, and his graduate student, Gerard Blanchard, assisted Dr. Sanny in acquiring materials and data necessary to his research with Dr. McPherron. Mr. Todd King, a system programmer with the group provided technical assistance with computer access at UCLA. During the summer of 1993 Dr. Sanny spent full time at UCLA interacting with the above mentioned individuals as well as with Dr. Gene Stringer. Dr. Stringer is another JOVE scholar for which Prof. McPherron has become an unsupported mentor. Dr. Sanny has continued since the end of the grant to maintain contact with Prof. McPherron and has initiated several other NASA related research projects. One of these has been performed by an undergraduate physics major at his university.

Dr. Sanny began a research project utilizing data from the ISEE-1/2 magnetometers, a NASA project for which Prof. McPherron was a coinvestigator with another UCLA faculty member, C. Russell. This project also made use of data stored in a computer data base at the National Space Science Data Center under the auspices of the coordinated data analysis workshop #6 (CDAW-6). The goal of the project was to examine the dynamic behavior of the plasma sheet during substorms to determine whether plasma sheet thinning might play a role in the onset of substorm expansions. Prof. McPherron had begun this project with two other space physicists, Dr. Dan Baker, and Dr. Tuija Pulkkinen.

Dr. Sanny made good progress on the project and was able to prepare a paper presented at a meeting of the American Geophysical Union. Dr. Sanny subsequently completed a manuscript describing this work which was recently published in the J. Geophysical Research. The report notes that both spacecraft were close to the neutral sheet at approximately 13 Re and 0130 local time. The spacecraft were too close to the neutral sheet to detect plasma sheet thinning. However, they did detect current sheet thinning. Immediately after the interplanetary magnetic field turned southward the current sheet began to thin exponentially with an e-folding time of 14 minutes. Within about 40 minutes the current sheet thinned from 12 Re to less than 1 Re. At this point the substorm expansion began and the current sheet collapsed to a thickness of less than 1000 km. As Dr. McPherron and others have shown elsewhere there is strong evidence that an x-line had formed earthward of the spacecraft and it was reconnecting lobe magnetic flux. The

paper by Dr. Sanny is important because it has long been recognized that the process of magnetic reconnection requires a thin current sheet with a weak vertical component of magnetic field across the sheet. This is exactly what developed as shown in this paper.

Dr. McPherron's support helped him complete his part in the collaboration with Pulkkinen and Baker which studied this event and the process of current sheet thinning by means of magnetic field models. As shown in the Pulkkinen paper, these other results are in complete agreement with the in situ observations reported by Dr. Sanny.

In conclusion, we are happy to report that the JOVE support of the collaboration between Dr. Sanny and Dr. McPherron was very fruitful and resulted in an important scientific paper which we hope will be frequently noticed as studies of the substorm process continue. Below we tabulate papers partially supported by this grant.

### **Reports and Publications:**

Pulkkinen, T.I., D.N. Baker, D. Mitchell and R.L. McPherron, Global and local current sheet thickness estimated during the late growth phase, 29th Plenary Meeting of COSPAR, Washington, D.C., August, 1992.

Pulkkinen, T.I., D.N. Baker, D.G. Mitchell, R.L. McPherron, C.Y. Huang, and L. A. Frank, Global and local current sheet thickness estimated during the late growth phase, Substorms 1, *Eur. Space Agency Spec. Publ.* 335, 131, 1992

Pulkkinen, T.I., D.N. Baker, D.G. Mitchell, R.L. McPherron, C.Y. Huang, and L. A. Frank, Thin current sheets in the magnetotail during substorms: CDAW 6 revisited, *J. Geophys. Res.*, 99(A4), 5793-5803, 1994.

Sanny, J., R.L. McPherron, and T.I. Pulkkinen, Growth-phase thinning of the near-earth current sheet (Abstract # S32b-01), *Eos*, 73 (43), 470, 1992.

Sanny, J. R.L. McPherron, C.T. Russell, D.N. Baker, T.I. Pulkkinen, and A. Nishida, Growth phase thinning of the near-earth current sheet during the CDAW 6 substorm, *J. Geophys. Res.*, 99(A4), 5805-5816, 1994.